ABSTRACT OF THE INVENTION

Gas-impermeable membranes containing a molten salt electrolyte in an electron-conducting matrix provide for mixed ion and electron conduction across the membrane. The membranes mediate transport of a selected ion for gas separation and or catalytic reactions at the membrane surface. The membranes are useful in catalytic membrane reactors, particularly for gas separation and full or partial oxidation reactions. The membranes are of particular interest for mediation of oxide ions, such as carbonate, for carbon dioxide separation or for partial oxidation reactions. Catalytic membrane reactors can incorporate catalyst layers on the membrane surfaces and or three-dimension catalysts, e.g., packed-bed catalysts, in the oxidation zone or the reduction zone of the reactor. The invention also relates to methods of gas separation and method for generating products employing the membranes and catalytic membrane reactors of this invention. Membranes and reactors of this invention that incorporate a molten carbonate salt are of particular use in the production of synthesis gas.